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# AN ADDITIONAL FOSSILIFEROUS MEMBER IN THE ALLEGHENY FORMATION (PENNSYLVANIAN) OF OHIO[1]

MYRON T. STURGEON AND WILLIAM M. MERRILL[2]
Ohio University and The Ohio State University

## INTRODUCTION

In eastern Ohio stratigraphic members of marine and brackish water origin are present in the Pottsville, Allegheny, and Conemaugh formations or series of the Pennsylvanian system. None is known in the overlying Monongahela formation, and only one brackish member occurs in the still higher Dunkard series of Permian age. In our Pennsylvanian, the marine and brackish members characteristically overlie a coal in the normal stratigraphic succession although many coals lack such overlying members. Coal and a marine and/or brackish water unit, together with other lithologic types, occur in a definite stratigraphic succession called a cyclothem by Weller (1932, footnote, p. 1003, *Correlation and Extent of Pennsylvanian Cyclothems* by H. R. Wanless and J. M. Weller. See also Weller, 1930, 1931, for further descriptive details). Many cyclothems occur above one another in the Pennsylvanian system of eastern and central North America, and a complete cyclothem has the following sequence of beds (See also Wanless, 1939, p. 8):

MARINE:

9. Shale containing clay ironstone bands and thin limestones
8. Limestone
7. Calcareous shale
6. Black shale

CONTINENTAL:

5. Coal
4. Underclay
3. Limestone
2. Sandy and micaceous shale
1. Sandstone

Disconformity

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In Ohio only two cyclothems, one associated with the Middle Kittanning coal in the Allegheny formation and another associated with the Anderson coal in the Conemaugh formation (Stout, 1939, 1947), are recognized as more or less complete. Inspection of Stout's stratigraphic charts shows that all other Ohio cyclothems are incomplete and that several may consist of as few as two members, although Stout and Lamborn (1924, pp. 238, 258, and 262) cite the occurrence of fossils in shale above the Upper Freeport coal in Center and Madison townships, Columbiana County, Ohio.

In the Allegheny formation five marine members are known to be present, and in ascending order these are the Putnam Hill limestone, Zaleski flint, Vanport limestone and flint, Hamden limestone and shale, and Washingtonville shale. The stratigraphic position of these members and their relationship to the other members of the cyclothem especially the underlying coals are shown in the following chart of the Allegheny formation which is modified from Stout (1947):[3]

| Member | Lithology | Thickness Ft. | Thickness In. |
|---|---|---|---|
| Upper Freeport, No. 7 | Coal, patchy | 3 | 0 |
| | Clay and shale | 7 | 0 |
| Upper Freeport | Limestone and marly shale | 2 | 0 |
| Bolivar | Coal, local, thin | 0 | 3 |
| Bolivar | Clay, flint and plastic | 5 | 0 |
| Upper Freeport | Shale or sandstone | 33 | 0 |
| Lower Freeport or Rogers | Coal, patchy | 1 | 0 |
| | Clay, impure | 2 | 6 |
| Lower Freeport | Limestone, local | 1 | 0 |
| Lower Freeport | Shale or sandstone | 25 | 0 |
| Upper Kittanning | Coal, local | 1 | 0 |
| | Shale and sandstone | 10 | 0 |
| *Washingtonville* | Shale, marine | 4 | 0 |
| Middle Kittanning, No. 6 | Coal, persistent | 4 | 0 |
| | Clay, siliceous | 3 | 6 |
| Salem | Limestone, impure, local | 0 | 6 |
| | Shale with red kidney ore | 10 | 0 |
| Strasburg | Coal, local | 0 | 6 |
| Oak Hill | Clay, flint and plastic | 4 | 0 |
| | Shale, siliceous | 3 | 0 |
| *Hamden* | Limestone, unsteady, marine | 4 | 0 |
| Lower Kittanning, No. 5 | Coal | 2 | 4 |
| | Clay, plastic | 5 | 0 |
| Lawrence | Coal, shaly, local | 0 | 4 |
| | Clay, flint and plastic | 6 | 0 |
| Kittanning | Shale and sandstone | 8 | 2 |
| Ferriferous | Ore, irregular | 0 | 8 |
| *Vanport* | Limestone, marine | 6 | 0 |
| Scrubgrass | Coal, local | 0 | 6 |
| | Shale, carbonaceous | 5 | 0 |
| Clarion, No. 4A | Coal, patchy | 4 | 0 |
| | Clay, flint and plastic | 5 | 0 |
| Canary | Ore, local | 0 | 6 |
| Clarion | Sandstone, irregular | 10 | 6 |
| Winters | Coal, local | 1 | 0 |
| *Zaleski* | Flint, impure, marine | 1 | 0 |

[3]Marine members are italicized.

| | | | |
|---|---|---|---|
| Ogan | Coal, local | 1 | 0 |
| | Shale and sandstone | 25 | 0 |
| *Putnam Hill* | Limestone, marine | 4 | 0 |
| Brookville, No. 4 | Coal, steady | 2 | 0 |
| | Total average thickness | 212± | 0 |

This is the accepted number of marine members in the Allegheny formation of Ohio at present, and Wanless (1939, p. 47) has stated that the Washingtonville shale "is the highest marine horizon in the Allegheny of the Appalachian field."

FIG. 1. East approach to the L. and M. Coal Co.'s strip mine on the southwest side of the Dorr Run valley, section 31, Ward Tp., Hocking Co., Ohio. The strip mine lies behind the tipple.

## DESCRIPTION OF DORR RUN SHALE

At present the Geological Survey of Ohio has in progress a stratigraphic and economic survey of the Hocking Valley area in which we are participating. During this work we have found a marine or brackish water shale member overlying the Lower Freeport coal in Athens (Sturgeon) and Hocking (Merrill) counties. We are not the first to find or recognize this fossiliferous member; for E. B. Andrews as early as 1870 (1871, p. 87) found and recorded fossil *Lingula* above the Lower Freeport coal in the vicinity of Kimberly which is located on Minkers Run (also called Meekers Run) near Nelsonville in Athens County. Sturgeon rediscovered *Lingula* specimens at Kimberly in 1945 and learned of Andrews' original discovery in a search through the literature. He called the junior author's attention to them during the field work of the present (1948) season. The shales in which these fossils occur are similar to other shales in the section and hence do not stand out lithologically, and the inconspicuous fossils are relatively few in number and kind.

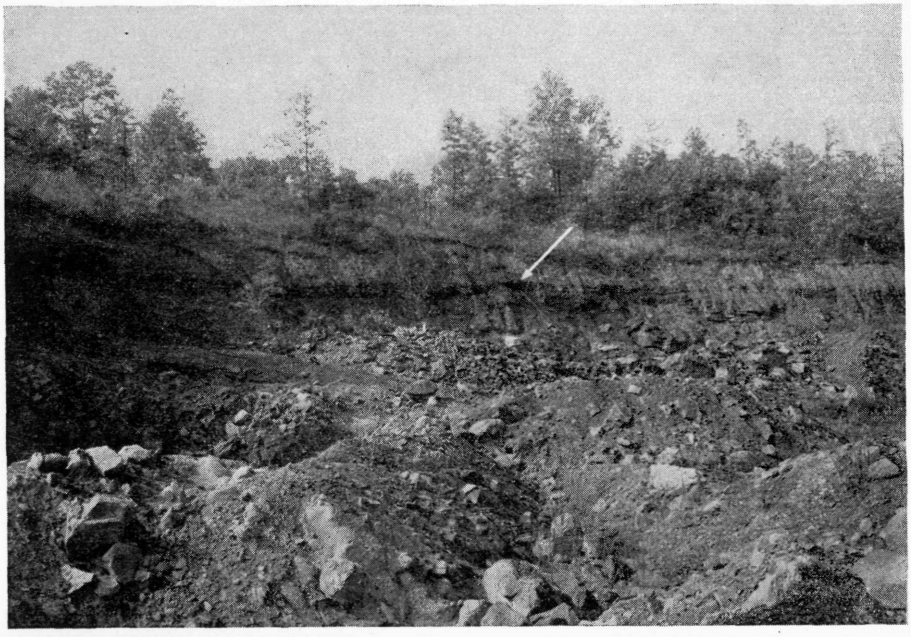

FIG. 2. Strip mine of the L. and M. Coal Co., section 31, Ward Tp., Hocking Co., Ohio. Arrow points to Lower Freeport coal and Dorr Run shale.

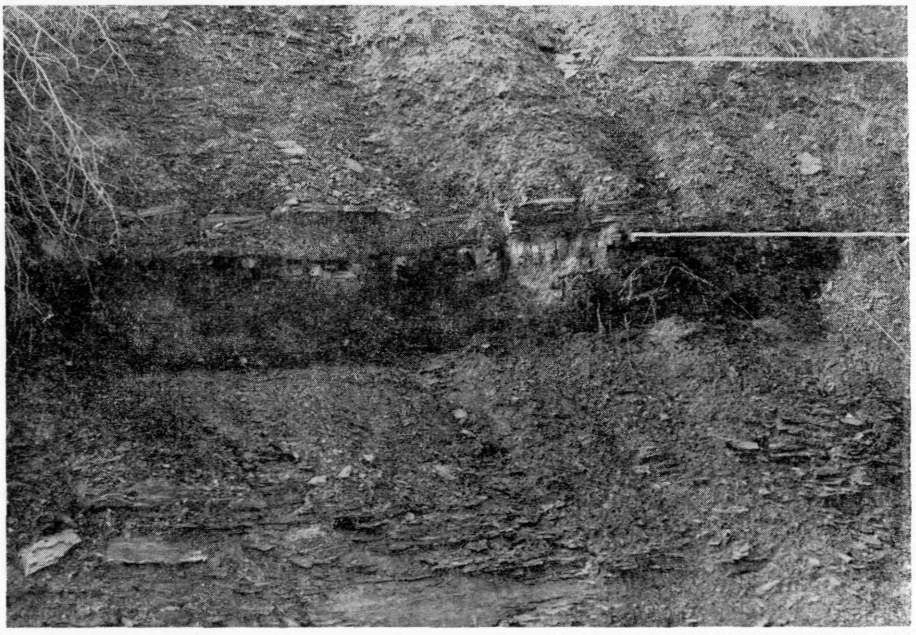

FIG. 3. Close view of Lower Freeport coal and Dorr Run shale shown in Fig. 2. White lines indicate top and bottom of the Dorr Run shale. Figs. 2 and 3 show the type exposure of the Dorr Run shale.

The more abundant fossils are *Lingula* and pectinoid clams, but other brachiopods and clams as well as gastropods, cephalopods, scaphopods, conodonts, and fish remains do occur. In view of the facts we believe it desirable to describe and name this member so that fellow workers in the Pennsylvanian of eastern Ohio will be on the alert for its occurrence elsewhere in the State.

We propose the name Dorr Run shale for this fossiliferous member overlying the Lower Freeport coal from an exposure on the southwest side of Dorr Run valley 1.6 miles northwest of the junction of the road along Dorr Run with the Logan-Nelsonville road (Route 33, mileage is from the junction of old Route 33 as shown on the topographic map and not from the present newer location of Route 33). The type section, located in the SW¼, NW¼, section 31, Ward Township, Hocking County, Ohio, is in an abandoned strip mine, but the entire section includes strata exposed along the side road from the vicinity of the 741 (elevation on topographic map) road intersection in the SE¼, NW¼, section 31. The strip mine was formerly operated by the L. and M. Coal Co. (now Liden Coal Co.) on the property of William Bowers and was first studied by Merrill. We have selected this exposure as the type not only because of its accessibility and probability of remaining exposed but also because it comes about as near as any exposure known to us of fulfilling the marine part of a typical cyclothem, although even here it is far from complete and typical (Figs. 1–3). The following section gives the succession of strata exposed both in the strip mine and along the secondary road extending from the Dorr Run road:

| | | Ft. | In. |
|---|---|---|---|
| 32. Sandstone, brown to gray with limonite stained surfaces, fine grained, micaceous, laminated, thin bedded or cross bedded, with few, greenish, shaly layers near top | *Upper* | 5 | 4 |
| 31. Clay-shale, gray, very sandy, micaceous | | 0 | 8 |
| 30. Clay-shale, dark gray to black, some limonite stain on surfaces, silty | *Freeport* | 3 | 8 |
| 29. Clay-shale, brown, ferruginous, silty | | 0 | 4 |
| 28. Shale, gray to olive drab, clayey to sandy, micaceous | | 2 | 11 |
| 27. Shale, gray to dark gray, argillaceous, fossiliferous clams, with scattered, small, limonite nodules in upper part | *Dorr* | 1 | 10 |
| 26. Shale, dark gray to black, fossiliferous | | 1 | 7 |
| 25. Coal, bony, shaly, fossiliferous | *Run* | 0 | 4 |
| 24. Shale, black, carbonaceous, argillaceous, fossiliferous | | 0 | 6 |
| 23. Coal, shaly to bony, some bright streaks | | 1 | 1 |
| 22. Clay-shale, dark gray, carbonaceous | | 0 | 6 |
| 21. Coal, bright, somewhat blocky, in thin layers | | 1 | 2 |
| 20. Clay, greenish gray, sandy, micaceous, slightly plastic, darker gray and more clayey with coaly streaks near top | *Lower Freeport* | 4 | 6 |
| 19. Sandstone, gray to greenish gray, fine grained, micaceous, thin bedded | | 6 | 4 |
| 18. Sandstone, brown to buff, medium to coarse grained, micaceous, massive | | 23 | 10 |

| | | Ft. | In. |
|---|---|---|---|
| 17. Shale, gray, silty, with coaly layers near base | | 3 | 0 |
| 16. Coal, bright to bony, thickness variable | *Middle* | 1 | 6 |
| 15. Clay, dark gray, plastic | | 0 | 3 |
| 14. Coal, bright, blocky | *Kittanning* | 2 | 5 |
| 13. Clay-shale, dark gray | | 0 | 2 |
| 12. Coal, bright, blocky | | 0 | 10 |
| 11. Clay, gray, sandy, plastic | | 1 | 0 |
| 10. Covered interval | | 15 | 0 |
| 9. Shale, greenish gray, silty | | 15 | 3 |
| 8. Coal, weathered | | 0 | 3 |
| 7. Clay, poorly exposed | *Lower* | 2 | 9 |
| 6. Sandstone, buff to brown, medium grained, medium bedded near base, micaceous, ferruginous, grades upward into light gray to white, fine grained, thin bedded, argillaceous, micaceous sandstone | *Kittanning* | 49 | 11 |
| 5. Covered interval | | 9 | 9 |
| 4. Shale, gray, argillaceous, containing layers and small nodules of limonite | | 8 | 0 |
| 3. Shale, gray, argillaceous, fossiliferous | *Putnam Hill* | 0 | 6 |
| 2. Coal, shaly to bright | *Brookville* | 0 | 1 |
| 1. Clay, light gray with dark gray top, very plastic | | 5 | 4 |

A comparison of the strata associated with the Lower Freeport coal in the above section with a theoretical complete cyclothem shows that the freshwater limestone (3), calcareous shale (7), marine limestone (8), and shale containing clay ironstone bands and thin limestones (9) are absent in the type section of the Dorr Run shale. Possibly the shale bearing the fossil clams (27) is a feeble representation of the calcareous shale (7) of a complete cyclothem.

A freshwater limestone in or below the Lower Freeport underclay is present at many places in Ohio as is shown in the following section measured along a secondary road at the ridge crest south of Snake Hollow in NW¼, NE¼, section 18, York Township, Athens County:

| | | Ft. | In. |
|---|---|---|---|
| 8. Shale, gray to olive drab | | | |
| 7. Shale, gray, argillaceous, sparingly fossiliferous in basal 2 inches | *Dorr Run* | 0 | 8 |
| 6. Coal, bright, blocky, with numerous, thin, dull, irregular partings including much fusain, free sulphur on weathered surfaces | | 1 | 0 |
| 5. Shale, dark gray to black, carbonaceous, with numerous fossil megaspores and thin coaly partings | *Lower* | 0 | 2 |
| 4. Coal, bright, blocky, with numerous dull partings of fusain and some pyrite, melanterite and free sulphur on weathered surfaces | | 0 | 5 |
| 3. Clay, gray, ferruginous, silty, sandy, micaceous, with scattered, small, limonite and pyrite concretions | *Freeport* | 5 | 10 |
| 2. Limestone, greenish gray, nodular, ferruginous, with network of thin, irregular, limonite partings and with some pyrite, embedded in light gray clay-shale | | 2 | 0 |
| 1. Shale, gray to olive drab | | | |

Here the Lower Freeport limestone is well developed, nodular, and ferruginous. A casual inspection at this locality did not show any fossils in the limestone, but a freshwater fauna of at least clams, ostracodes, and annelid worm tubes is present in the Lower Freeport limestone locally elsewhere in Ohio. The fossils in the Dorr Run shale seem to be restricted to the several inches immediately overlying the coal. It is possible, however, that fossils are present higher above the coal but unrecognizable because of the weathered condition of the shale.

Plate I is a chart which shows the thickness and character of the Lower Freeport coal and Dorr Run shale at all localities where we have found fossils in the Dorr Run shale. We have failed to find fossils above the same coal at other places within the area shown in the index map of Plate I, but we believe that fossils must certainly be present at some of the localities inspected and found wanting because of the weathered and slumped condition of the outcrop. It should be mentioned that weathered and slumped conditions do not prevail at all locations where no fossils were found. The following are descriptions of the locations at which the Lower Freeport and Dorr Run members are shown on Plate I. The elevation given for each location below is approximate for the Lower Freeport coal and the Dorr Run shale:

1. Exposure in L. and M. Coal Co.'s abandoned strip mine on the southwest side of Dorr Run valley, SW¼, NW¼, section 31, Ward Tp., Hocking Co., Ohio. This is the type exposure of the Dorr Run shale. Elevation: 910±.
2. Exposure on west side of Nelsonville-Minkers Run road, SW¼, SW¼, section 24 (unnumbered on topographic map), York Tp., Athens Co., Ohio. Elevation: 800±.
3. Exposure on west side of Nelsonville-Minkers Run road, SE¼, NE¼, section 29, York Tp., Athens Co., Ohio. Elevation: 830±.
4. Exposure in abandoned strip mine on north side of Minkers Run valley and northwest of Kimberly, NW¼, SE¼, section 16, York Tp., Athens Co., Ohio. Elevation: 730±.
5. Exposure in abandoned strip mine on south side of Minkers Run valley and west of Kimberly, south-center, section 16, York Tp., Athens Co., Ohio. Elevation: 735±.
6. Exposure in abandoned strip mine north of Route 33 and east of Happy Hollow road, SW¼, SW¼, section 11, York Tp., Athens Co., Ohio. Elevation: 735±.

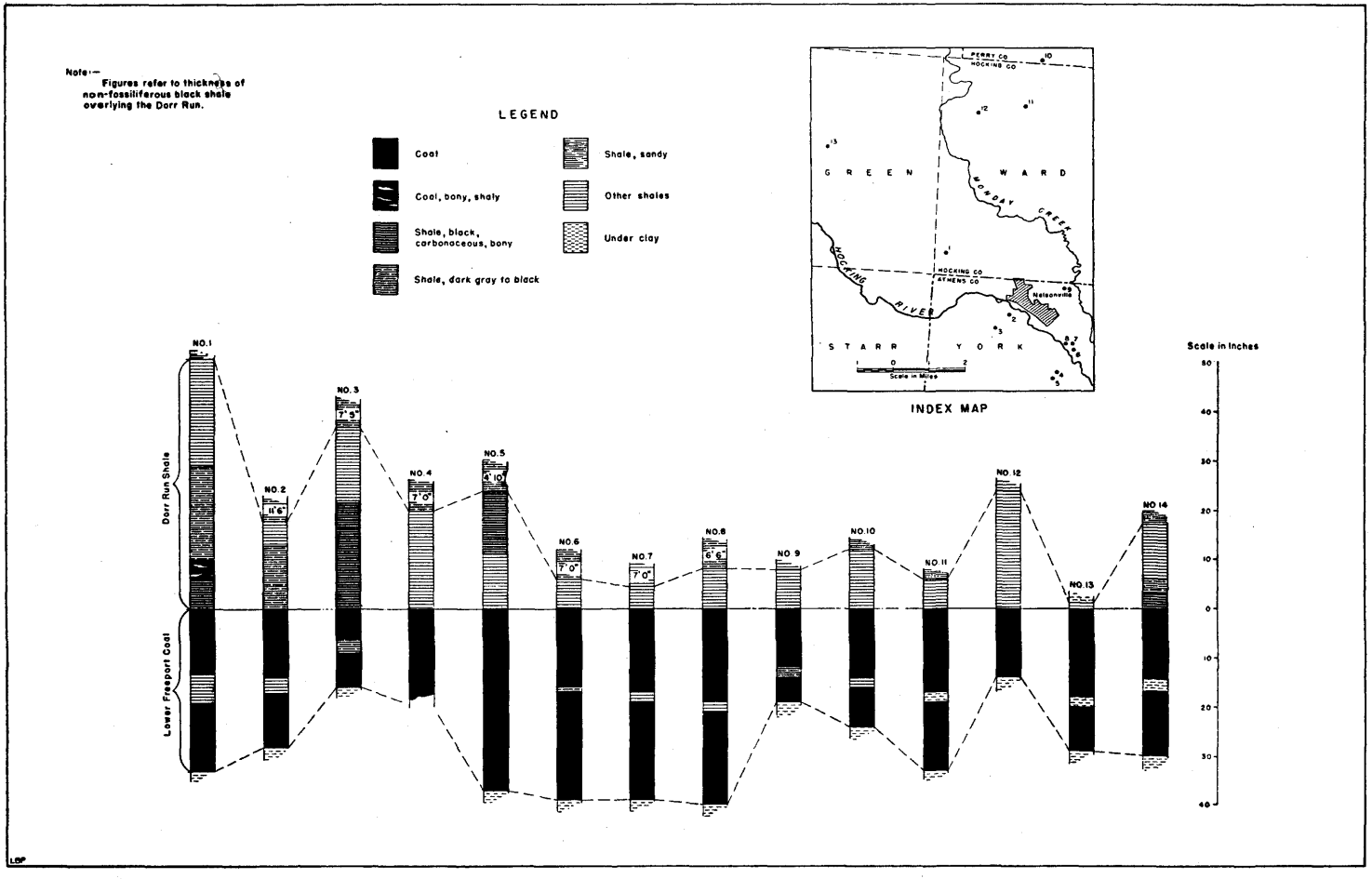


Chart showing thickness and character of the Lower Freeport coal and Dorr Run shale at all known exposures of the Dorr Run shale.

7. Exposure on west side of Happy Hollow road and short distance north of Route 33, NW¼, SW¼, section 11, York Tp., Athens Co., Ohio. Elevation: 735±.
8. Exposure at abandoned mine entrance on north side of Route 33, NE¼, SE¼, section 17 (unnumbered on topographic map), York Tp., Athens Co., Ohio. Elevation: 733±.
9. Exposure along both sides of secondary road at ridge crest south of Snake Hollow, NW¼, NE¼, section 18, York Tp., Athens Co., Ohio. Elevation: 790±.
10. Exposures in ravine on northeast side of Route 216, SW¼, SW¼, section 33, Coal Tp., Perry Co., Ohio. Elevation: 890±.
11. Exposure on west side of road, SE¼, NW¼, section 23, Ward Tp., Hocking Co., Ohio. Elevation: 890±.
12. Exposure on north side of road just south of Downhour School, NW¼, SW¼, section 29, Ward Tp., Hocking Co., Ohio. Elevation: 920±.
13. Exposure on north side of road at crest of hill between 992 and 828 road intersections, NE¼, SE¼, section 22, Green Tp., Hocking Co., Ohio. Elevation: 1045±.

The 14th stratigraphic section on Plate I is an average composite one of the Lower Freeport coal and Dorr Run shale for the localities at which we have found the Dorr Run shale. In the area studied by us the Lower Freeport coal has an average thickness of 30 inches and characteristically has a single parting of shale or clay with an average thickness of 2.5 inches. The average thickness of the lower bench of coal is 13 inches and of the upper bench 14.5 inches. The Lower Freeport where associated with the Dorr Run shale is not a coal of the highest quality, and while much of it is bright and blocky it tends to have considerable fusain and pyrite and locally to become shaly and bony.

The Dorr Run shale has a known average thickness of 17 inches. It is very probable that the average thickness is too small; for a more thorough search would likely reveal fossils scattered through part of the considerable thickness of dark shale that overlies the Lower Freeport coal in part of York Township of Athens County. The Dorr Run member is typically a gray to dark gray or even black, argillaceous, carbonaceous, fossiliferous, marine shale, but in the vicinity of Downhour School in Ward Township of Hocking County it is light gray and argillaceous. The typical Dorr Run shale is lithologically quite similar to the type Washingtonville shale, but except for the pectinoid clams the faunas of these two shales do not seem very much alike. Studies, when complete, may show more similarities than are now apparent between these two faunas.

On the basis of the stratigraphic evidence available we suggest the following addition and modification to the Lower Freeport cyclothem in Ohio:

| | | Ft. | In. |
|---|---|---|---|
| 6. Shale, gray to olive drab, silty to sandy | | | |
| 5. Shale, gray to black, argillaceous and/or carbonaceous, fossiliferous, marine, locally present | *Dorr Run* | 1 | 6 |
| 4. Coal, locally present | | 1 | 0 |
| 3. Underclay, impure | *Lower* | 2 | 6 |
| 2. Limestone, freshwater, locally present | | 1 | 0 |
| 1. Sandstone and shale | *Freeport* | 25 | 0 |
| Disconformity | | | |

The only change that we have made is the addition of the Dorr Run shale member, and for the remainder of the Lower Freeport cyclothem we have used Stout's descriptions and average thicknesses. This seems feasible, since his studies are based on many sections over the entire eastern part of Ohio and our studies are of local extent. In our sections, however, the Lower Freeport coal has an average thickness of about 30 inches and a 2.5-inch shale or clay parting near the middle (Plate I). The discovery of the Dorr Run shale member makes a total of three cyclothems in the Pennsylvanian of Ohio that are more or less complete. Additional studies in Ohio and elsewhere may add facts that will warrant further modifications in our understanding of the Lower Freeport coal and associated strata.

## DORR RUN FAUNA

The better of the known collecting localities for Dorr Run shale fossils are at the type area and along the Nelsonville-Minkers Run road at localities 2 and 3 as shown on Plate I. The fauna is not large and has not been completely studied, but our present knowledge indicates that the assemblage of fossils is more extensive than we believed at the beginning of our joint study. There have been collected about 18 different kinds of Dorr Run fossils to date, but several of these because of poor preservation or of too few specimens are very inadequately represented. The tentative fossil list, including genera and species as far as possible, is as follows:

I. BRACHIOPODA:
   1. *Lingula carbonaria* Shumard.
   2. *Orbiculoidea missouriensis* (Shumard).

II. PELECYPODA:
   1. *Aviculopecten* aff. *eaglensis* (Price).
   2. *Cardiomorpha* sp.
   3. *Dunbarella knighti* Newell?
   4. *Naiadites* ? sp.
   5. "Solenomya" sp.

III. GASTROPODA:
   1. *Patellilabia* sp.
   2. Unidentified pleurotomarid genus.
   3. Unidentified high spired genus.

IV. SCAPHOPODA:
   1. *Plagioglypta meekiana* (Geinitz)?

V. CEPHALOPODA:
   1. *Pseudorthoceras knoxense* (McChesney)?
   2. *Metacoceras* sp.

VI. CONODONTS:
   1. *Hibbardella?* sp.
   2. *Hindeodella* sp.
   3. *Idiognathodus* sp.
   4. *Ozarkodina* sp.
   5. *Streptognathodus* sp.

VII. VERTEBRATA:
   1. Fish scales and spines.

The fossils and the lithology of the Dorr Run shale do not indicate a normal marine environment at the time of deposition but rather near shore and shallow water conditions. Dr. Youngquist, during his identification of the conodont genera, observed from their occurrence with fish remains and fragments of fossil

wood, that the environment was "perhaps a near shore, estuary or lagoon facies . . . " He was particularly interested in the association of the conodonts with the remains of fish and plants, both associations of which, he points out, are known elsewhere. Dr. Newell after an inspection of the Dorr Run pelecypods believes "that the pelecypods are marine, although they may be representatives of a subnormally saline marine environment."

The absence of brachiopods with calcareous shells and of other fossils commonly found in the Pennsylvanian marine members of Ohio may further substantiate a shallow water, near shore environment, although the dark muds were certainly in part responsible for the absence of some of them. The few cephalopod and gastropod shells may have floated in after the death of their owners, but such a means of transportation seems unlikely for the scaphopod shells which are open at both ends.

The dark gray to black color of most of the shale should be indicative of a considerable amount of contained carbonaceous matter. The fossil plants, while not abundant, include both woody material and a few leaves. These facts probably also indicate a near shore environment. A recent chemical analysis of the dark gray and black shale from locality 4 near Kimberly by the Geological Survey of Ohio showed, however, that the shale is more than 90% ash.

From the available evidence it seems probable that the Dorr Run shale represents the black shale which is the basal marine unit of a typical cyclothem. Marine conditions seem to have developed no further in Dorr Run time and instead were shortly replaced by the deposition of dark muds under a continental environment. The sea threatened an invasion but never firmly established itself in Ohio during the deposition of the Lower Freeport-Dorr Run cyclothem.

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